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Patentanmeldung Nr. Patent application No. Demande de brevet n°

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Bezeichnung der Erfindung/Title of the invention/Titre de l'invention:
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Fischer-tropsch catalyst composition

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FISCHER-TROPSCH CATALYST COMPOSITION

5 The present invention relates to a catalyst composition suitable for the conversion of carbon monoxide and hydrogen to C_5^+ hydrocarbon mixtures, comprising a Fischer-Tropsch catalyst component and an acidic component. The invention further relates to a process for the conversion of carbon monoxide and hydrogen to C_5^+ hydrocarbon mixtures using this catalyst.

10 It is known to convert carbon monoxide and hydrogen to larger hydrocarbons using a composition comprising a Fischer-Tropsch catalyst component and an acidic component.

For instance, US 4,595,702 discloses a Fischer-Tropsch process using an copper-containing iron catalyst as Fischer-Tropsch catalyst component and a
15 zeolite selected from the group of ZSM-5, ZSM-45 and zeolite beta as the acidic component.

US 4,556,645 discloses the combined use of a Fischer-Tropsch catalyst component and a crystalline, microporous silicoaluminophosphate, non-zeolitic molecular sieve as the acidic component.

20

It has now been found that a better performance can be reached when zeolite Y is used as the solid acid. This zeolite Y may be steam-stabilized or non-steam-stabilized. More preferably, zeolite Y contains a metal compound, e.g. a transition metal and/or rare earth metal compound.

25 Hence, the present invention relates to a catalyst composition suitable for the conversion of carbon monoxide and hydrogen to C_5^+ hydrocarbon mixtures, comprising

- (a) a Fischer-Tropsch catalyst component, and
- (b) zeolite Y.

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This zeolite Y preferably has a SAR of above 4.0, more preferably 5.0-10.0 and preferably contains one or more metal compounds. Examples of suitable metals are rare earth metals, e.g. Ce, La, and transition metals of Groups IV-VIII of the Periodic System, e.g. V, Cr, Mn, Fe, Co, Ni, Cu, Zr, Nb, Ru, Re, etc.

- 5 The metal compound is preferably present in or on the zeolite in amounts of 0.1 to 10 wt%, more preferably 0.3 to 2 wt%, calculated as oxide.

The metal compound can be supported on the zeolite Y in any manner known in the art. Examples of such methods are impregnation, ion-exchange, and deposition precipitation of soluble metal salts.

- 10 If desired, the metal-containing zeolite Y is calcined after the metal compound has been deposited.

- 15 The Fischer-Tropsch catalyst component can be any conventional Fischer-Tropsch catalyst, preferably comprising iron and/or cobalt. For the preparation of such catalysts it is referred to, e.g., WO 01/97968, WO 01/89686/ and WO 01/70394.

The Fischer-Tropsch catalyst component can be promoted with various metals, e.g. Al, Ti, Cr, Mn, Ca, Na and/or K. Furthermore, the Fischer-Tropsch catalyst component can contain binder materials, such as silica and/or alumina.

20

The amount of zeolite Y in the catalyst composition according to the invention preferably ranges from 5 to 40 wt%, more preferably from 10 to 30 wt%, based on the total weight of the catalyst composition.

- 25 The catalyst composition can be a physical mixture of Fischer-Tropsch catalyst component particles and zeolite Y particles. On the other hand, the catalyst composition can also comprise one type of particle, containing both the Fischer-Tropsch catalyst component and the zeolite Y.

- 30 The invention further relates to a process for the conversion of carbon monoxide and hydrogen to C_5^+ hydrocarbon mixtures, said process comprising

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contacting carbon monoxide and hydrogen with the above catalyst composition comprising a Fischer-Tropsch catalyst component and zeolite Y.

This process can be carried out in any suitable reactor, such as a (fixed) fluidised bed reactor.

- 5 This process is preferably a high-temperature Fischer-Tropsch process. The temperature ranges preferably from 250° to 400°C, more preferably from 300° to 370°C, and most preferably from 330° to 350°C. The pressure preferably ranges from 10 to 60 bar, more preferably 15 to 30 bar, and most preferably about 20 bar.
- 10 The H₂/CO volume ratio preferably ranges from 0.2 to 8.0, preferably 0.5-6, most preferably 1-3.

The resulting hydrocarbon product preferably contains, on a mass basis, at least 35%, more preferably at least 45%, and most preferably at least 50% of

- 15 C₅⁺ compounds. The process may be used for the production of aromatics, branched hydrocarbons, and/or olefins. Preferably, the process is used for the production of liquid fuel, especially gasoline and preferably unleaded gasoline.

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CLAIMS

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1. Catalyst composition suitable for the conversion of carbon monoxide and hydrogen to C_5^+ hydrocarbon mixtures, comprising
 - 5 (a) a Fischer-Tropsch catalyst component, and
 - (b) zeolite Y.
 2. Catalyst composition according to claim 1 wherein the zeolite Y contains a metal compound.
10
 3. Catalyst composition according to claim 2 wherein the metal compound comprises a metal selected from the group consisting of Group IV metals, Group V metals, Group VI metals, Group VII metals, Group VIII transition metals, rare earth metals, and combinations thereof.
15
 4. Catalyst composition according to any one of claims 1-3 wherein the Fischer-Tropsch catalyst component comprises iron.
 5. Catalyst composition according to any one of claims 1-3 wherein the
20 Fischer-Tropsch catalyst component comprises cobalt.
 6. Catalyst composition according to any one of the preceding claims wherein zeolite Y is present in the catalyst composition in an amount of 5 to 40 wt% based on the total weight of the catalyst composition.
25
 7. Process for the conversion of carbon monoxide and hydrogen to C_5^+ hydrocarbon mixtures, said process comprising contacting carbon monoxide and hydrogen with a catalyst composition according to any of the claims 1-6.

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Abstract

The present invention relates to a catalyst composition suitable for the conversion of carbon monoxide and hydrogen to C_5^+ hydrocarbon mixtures. This catalyst composition comprises a Fischer-Tropsch catalyst component and zeolite Y. Preferably, the zeolite contains one or more metal compounds.

PCT Application

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